

Overview of North American freshwater mussels

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Chicago, IL, August 23 and 24, 2005

Native freshwater mussels Unionoids, naiades, or “pearly mussels”

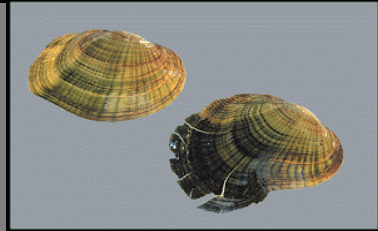
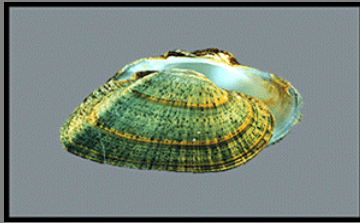
Not to be confused with:

Introduced zebra mussels
(*Dreissena*)

Introduced Asian clam
(*Corbicula*)

Native fingernail clams
(Sphaeriidae)





Unionidae: NA, CA, Eurasia



Margaritiferidae:
NA, Eurasia

Diversity: 297 North American species

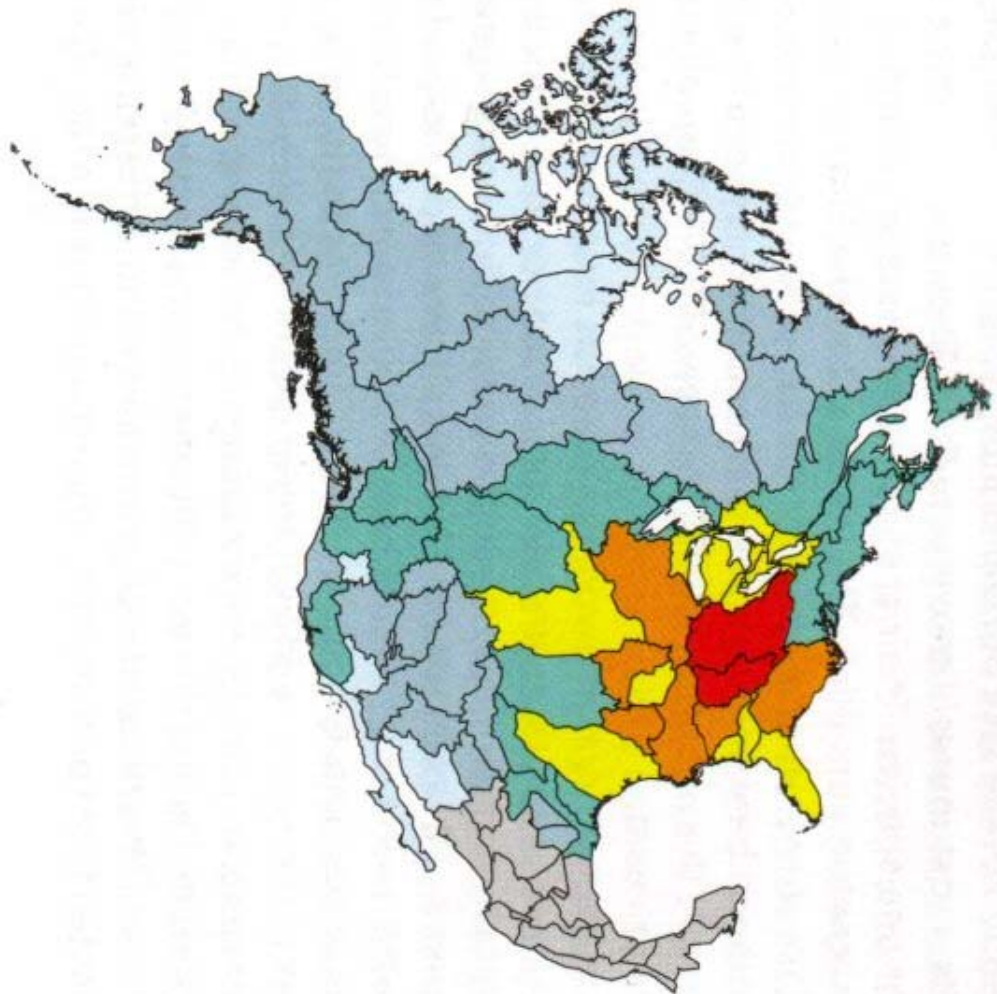


Distribution:

Unionid species richness by ecoregion

Abell et al., 2000

Freshwater ecoregions of North America: a conservation assessment.



LEGEND

100–125 species	1–4 species
50–99 species	No species present
25–49 species	No data
5–24 species	

Figure 3.7a Unionid mussel richness.

Importance of native mussels

- Mussels are a dominant component of the benthic community of many rivers and lakes
- Ecological significance as suspension feeders: trophic link
- Economic significance- buttons & pearls
- Conservation significance

Shellfish buffet- muskrat midden on the Meramec River



Harvest for button industry...

1880-1945



FIG. 2.—Barges loaded with shells and two shellers' house-boats, in Arkansas. (See p. 59.)

F., 1917-18.

PLATE XXXII.



FIG. 1.—Sorting table and heap of shells on river bank. (See p. 60.)

Historical abundance

1916- commercial shell harvest

~140 million pounds



Fig. 2. Mountains of shells rose up alongside the Mississippi as clammers made a living harvesting mussels to supply the button industry.

Pearl buttons



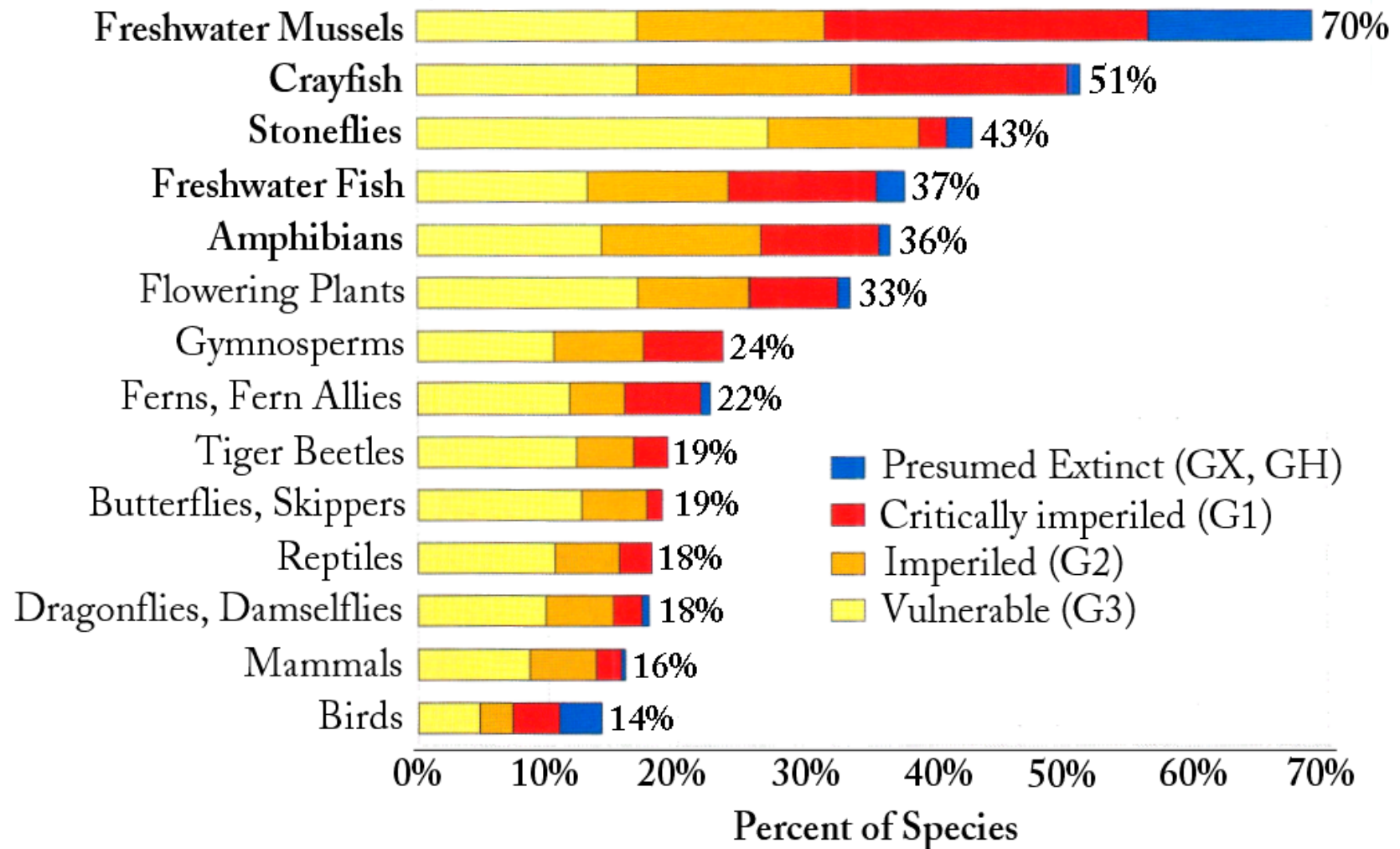
Modern shell harvest for pearl culture



Cultured Pearls

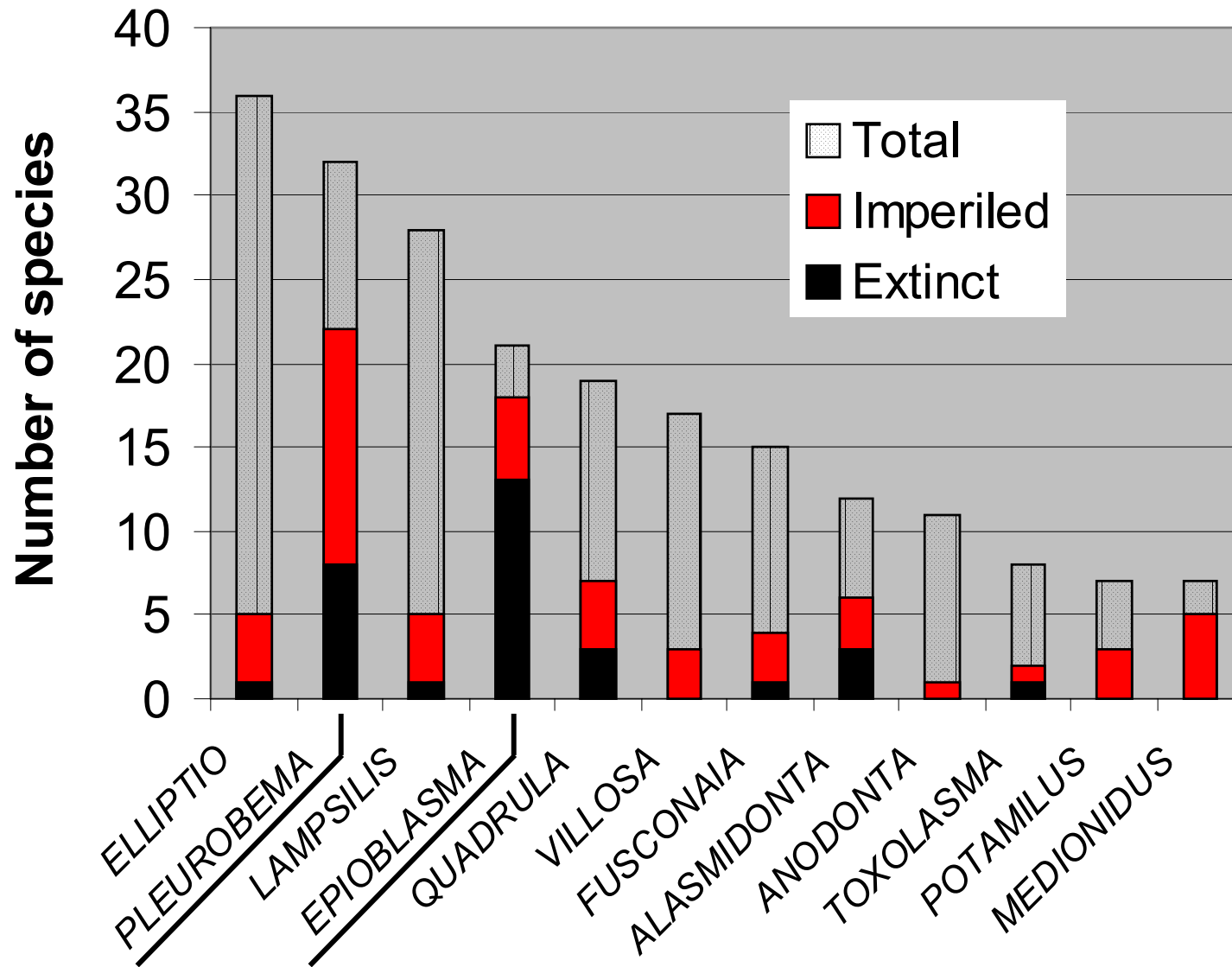


Endangered Species in North America



Stein et al. 2000

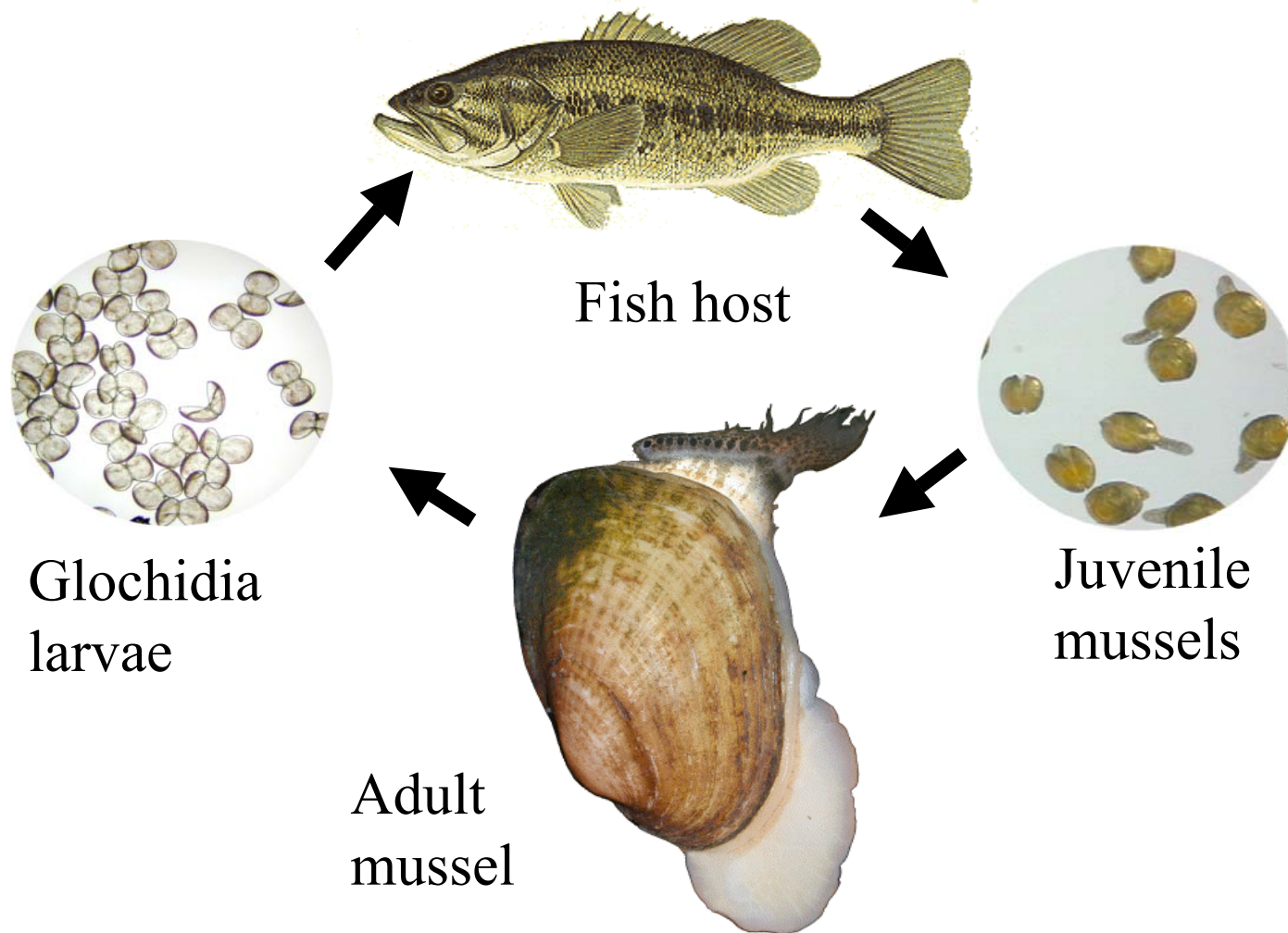
Conservation status of the 10 largest NA Unionid genera

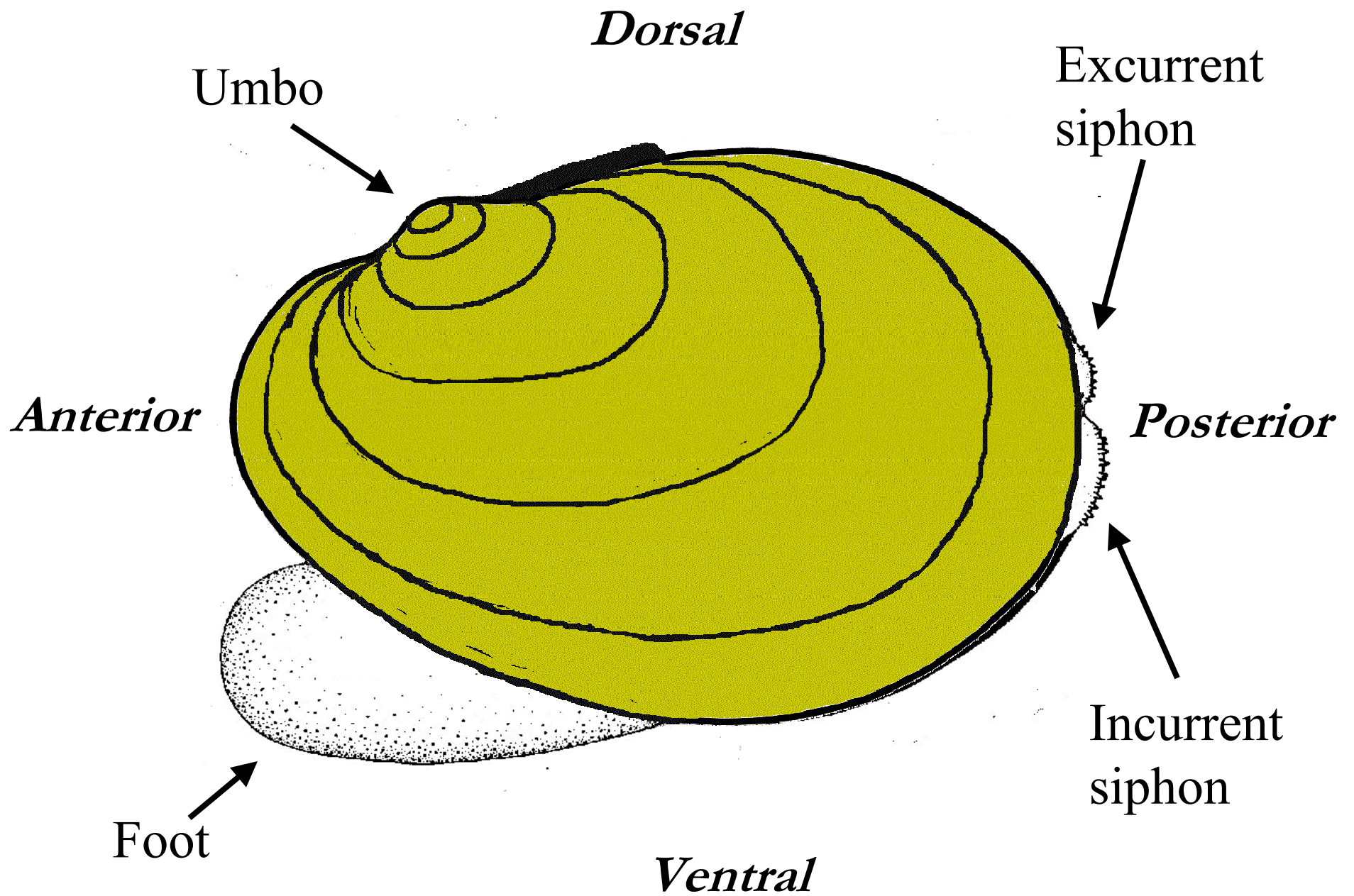


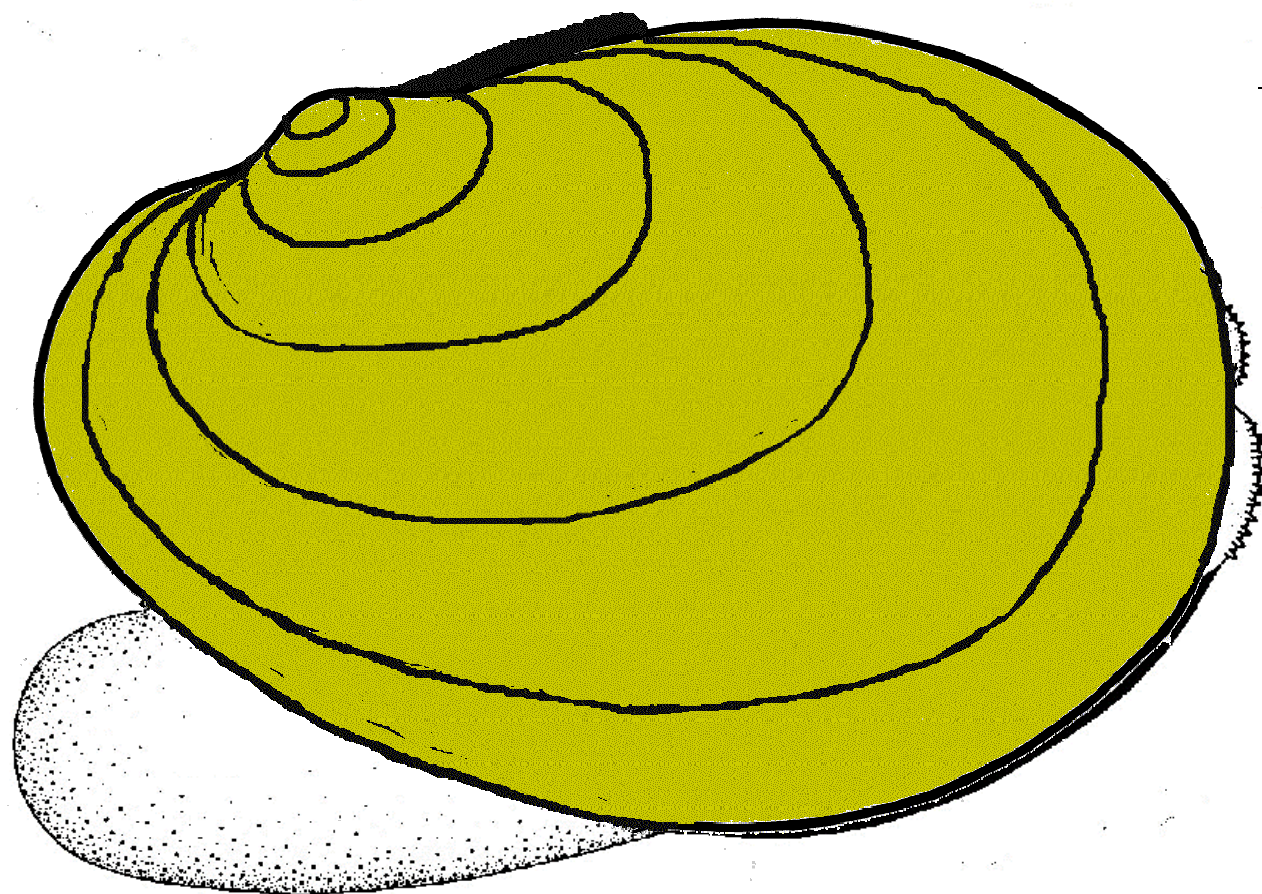
A vulnerable life-history

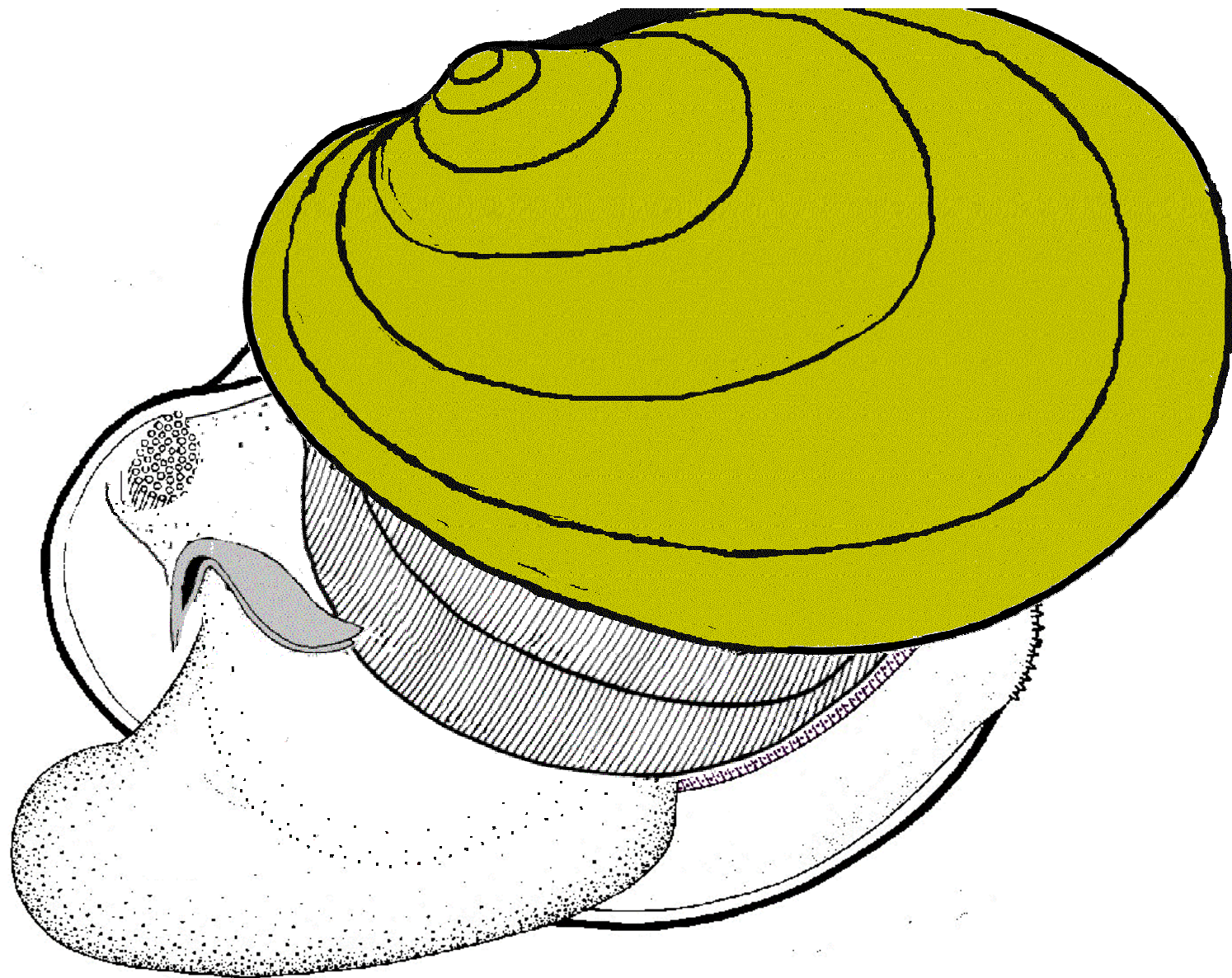
- Long lived adults require stable benthic habitats in rivers
- filter feeders intimately exposed to water-borne pollutants.
- High-risk parasitic larval stage, dependent on native fish hosts.
- Tiny juveniles susceptible to drift, siltation, micropredators, sediment toxicity

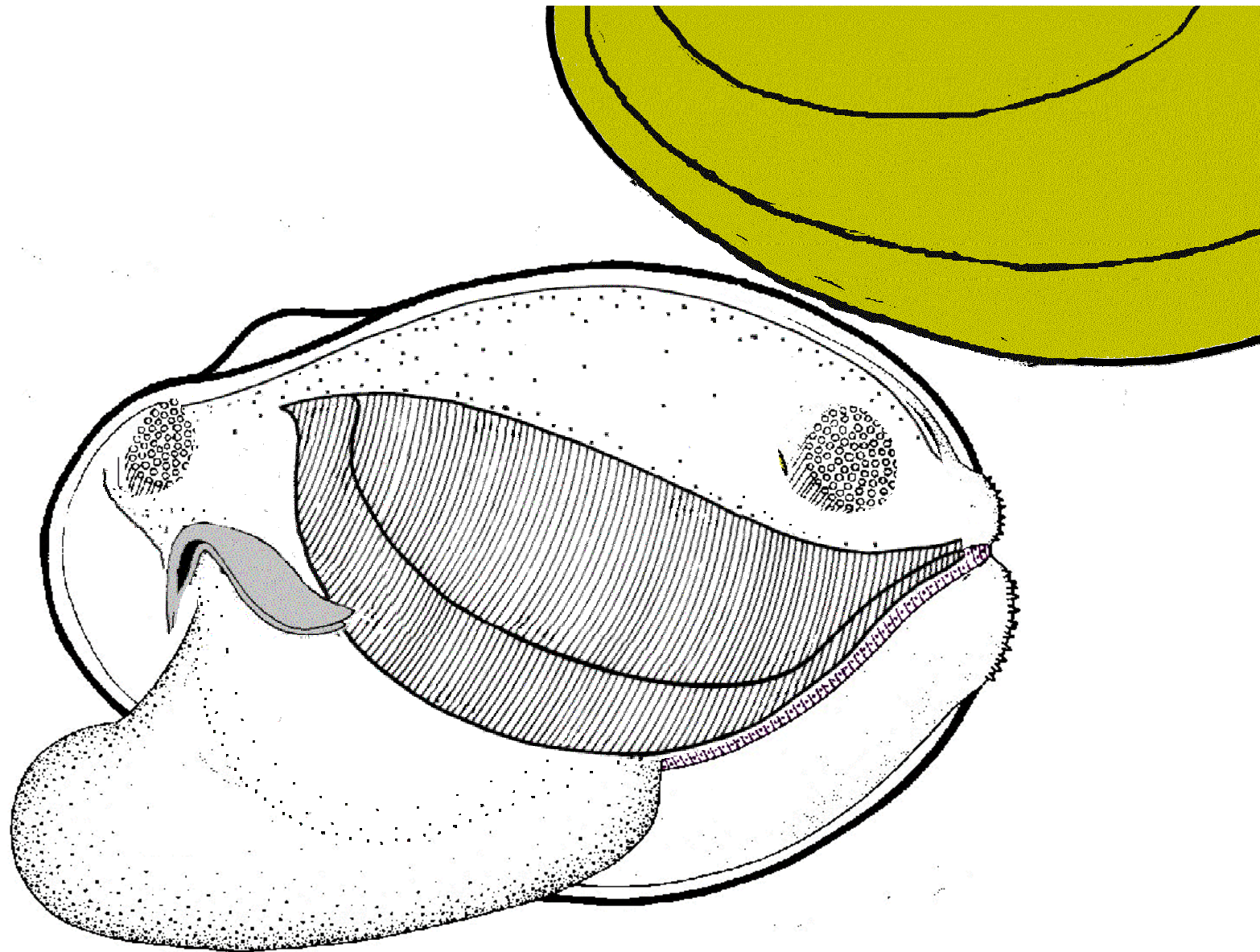
Native mussel life history

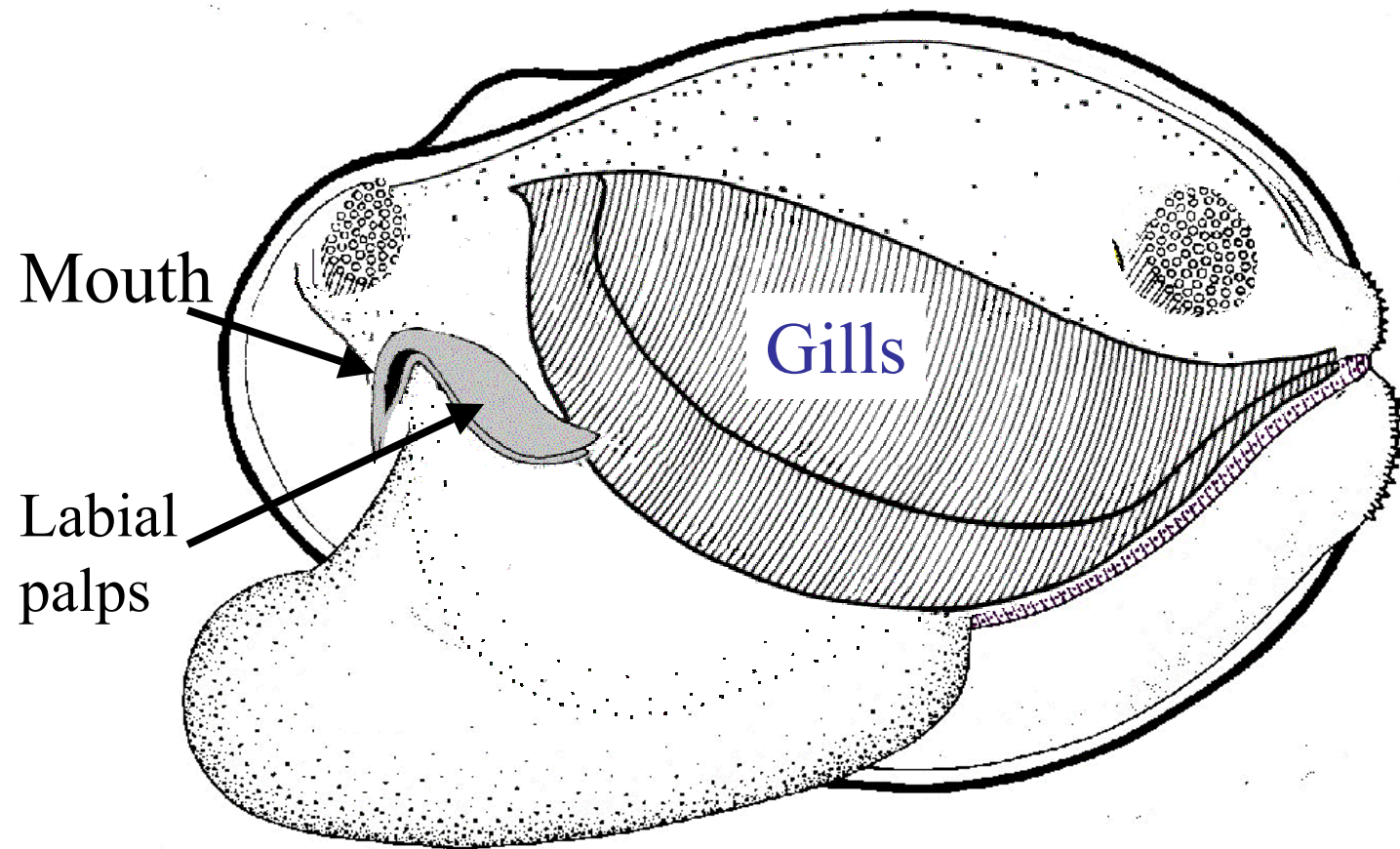


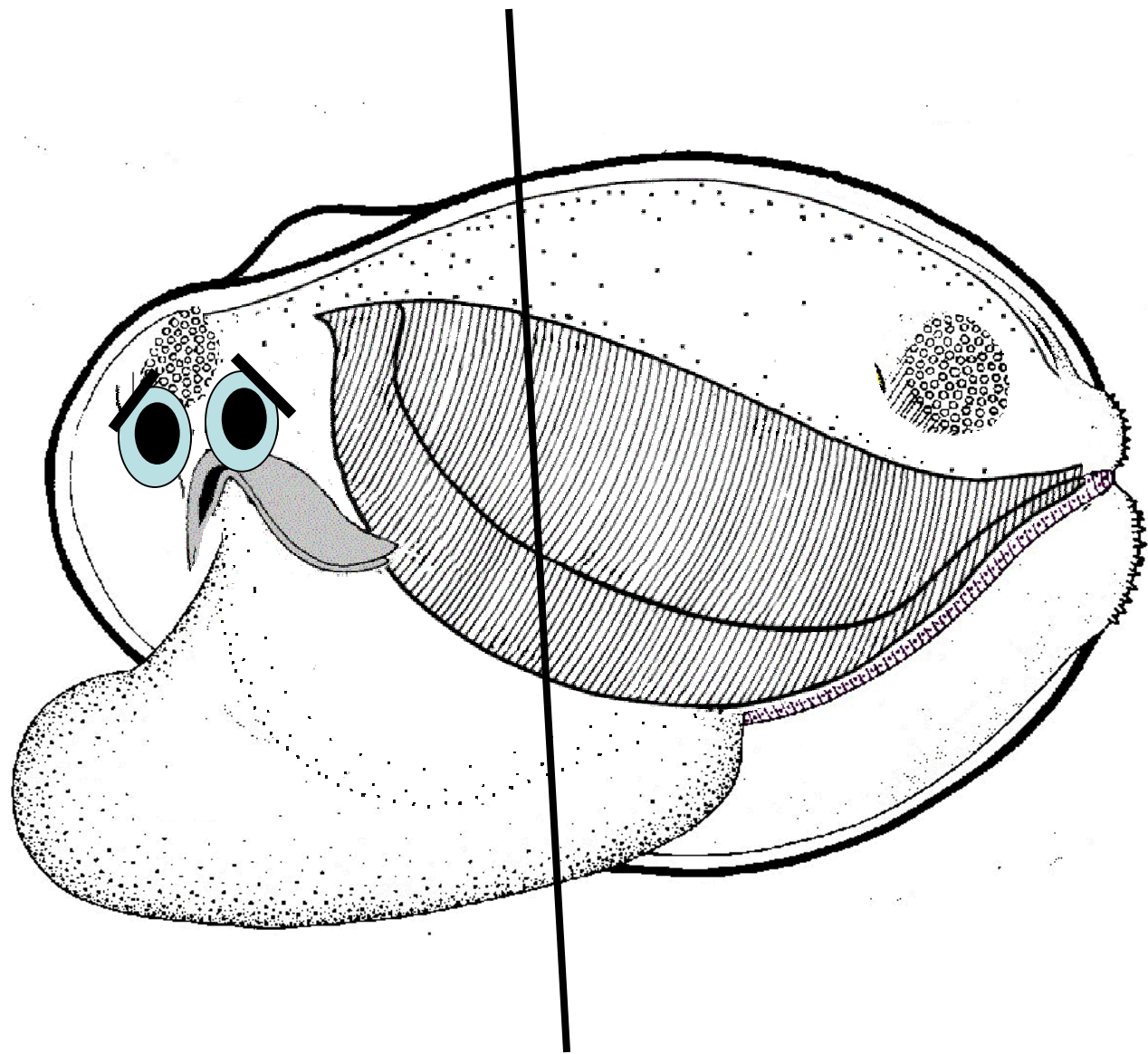


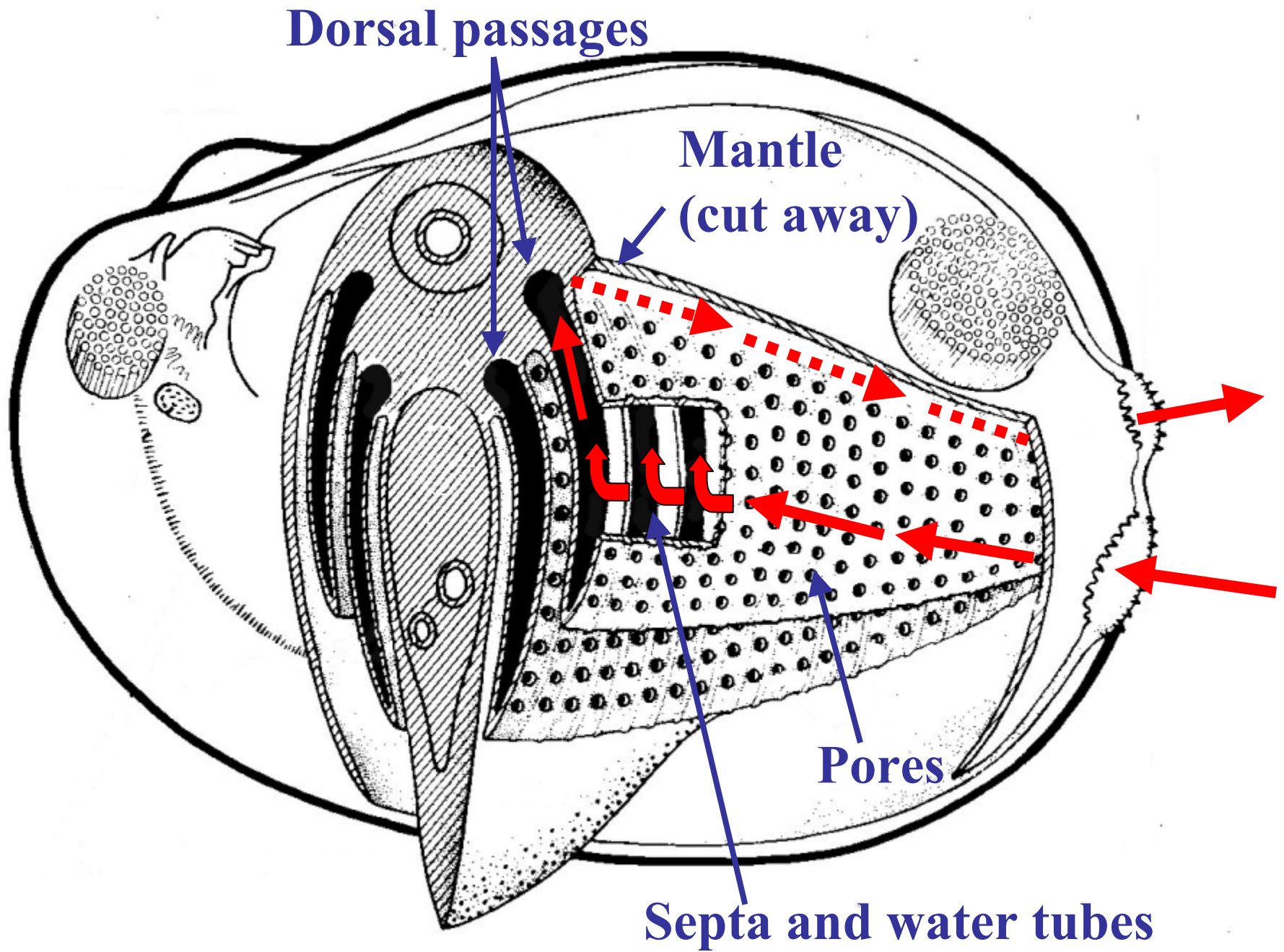














Sieving for a living



Food sources

- Detritus, bacteria, phytoplankton, zooplankton
- Particle sorting –pseudofeces production
- Isotope studies suggest that river species assimilate mainly bacterial carbon while lake species rely more on phytoplankton (Nichols and Garling 2000)

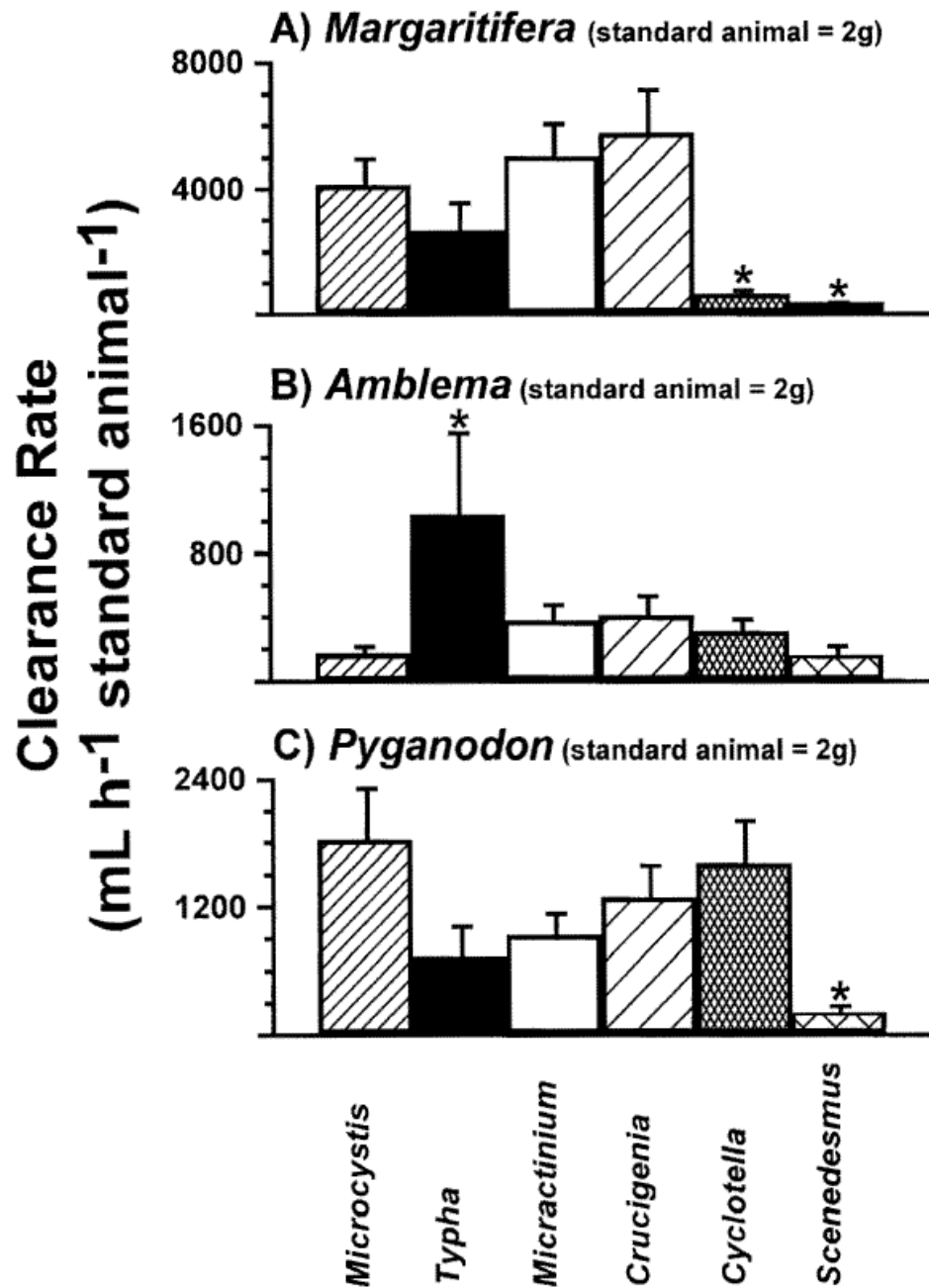
Suspension vs. deposit feeding

- Juveniles are interstitial which confounds the distinction.
- Adult mussels are generally thought to feed primarily from water column
- However, study by Raikow & Hamilton (2001) suggests that adult unionids may also deposit feed.

Filtration rates

3 species ranged from
0.2-6 L/mussel·hour
(5-144 L/mussel·day)

Baker & Levinton 2003



Juvenile *Lampsilis* water currents


1 mm

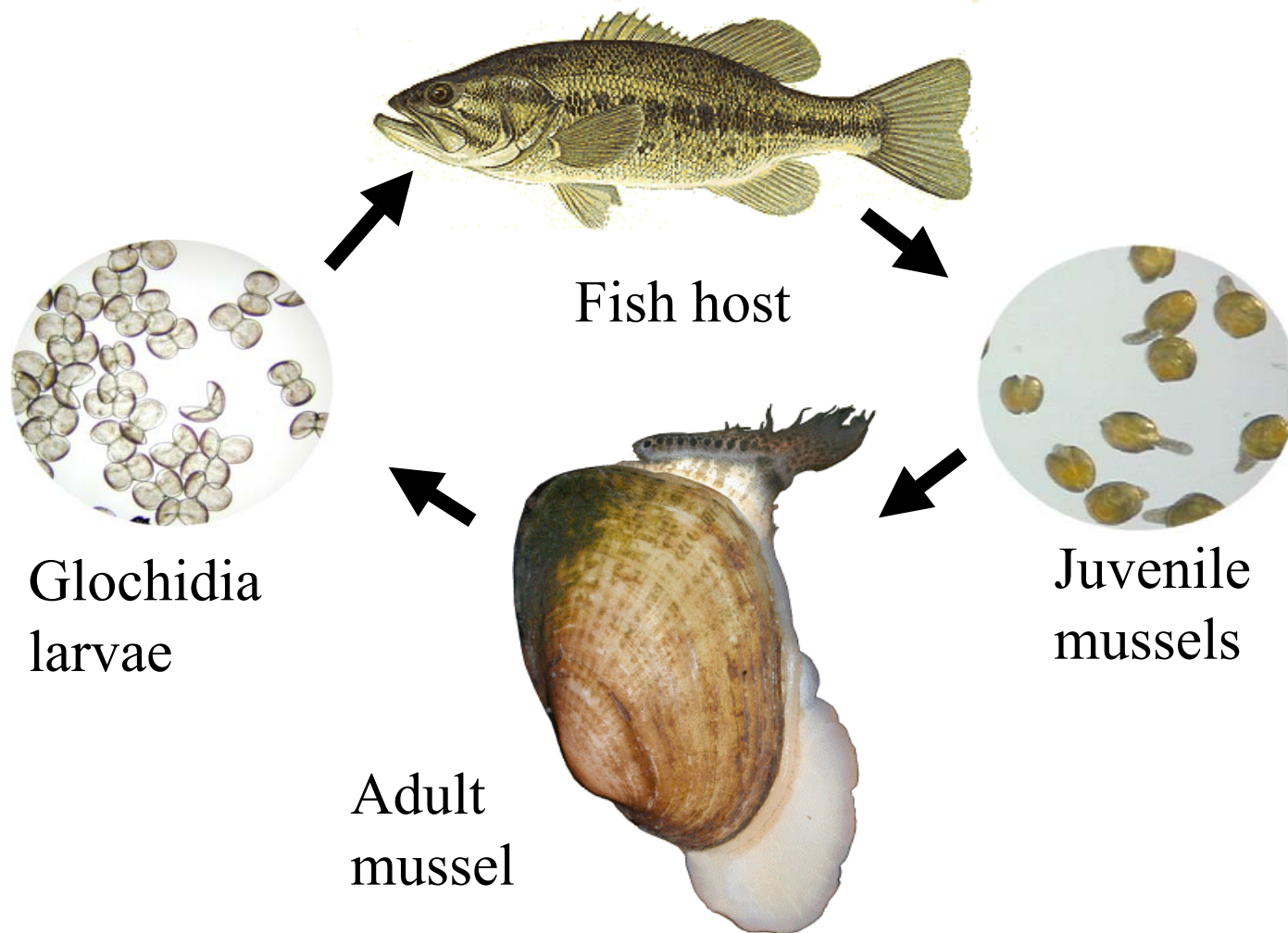


Juvenile *Lampsilis* water currents

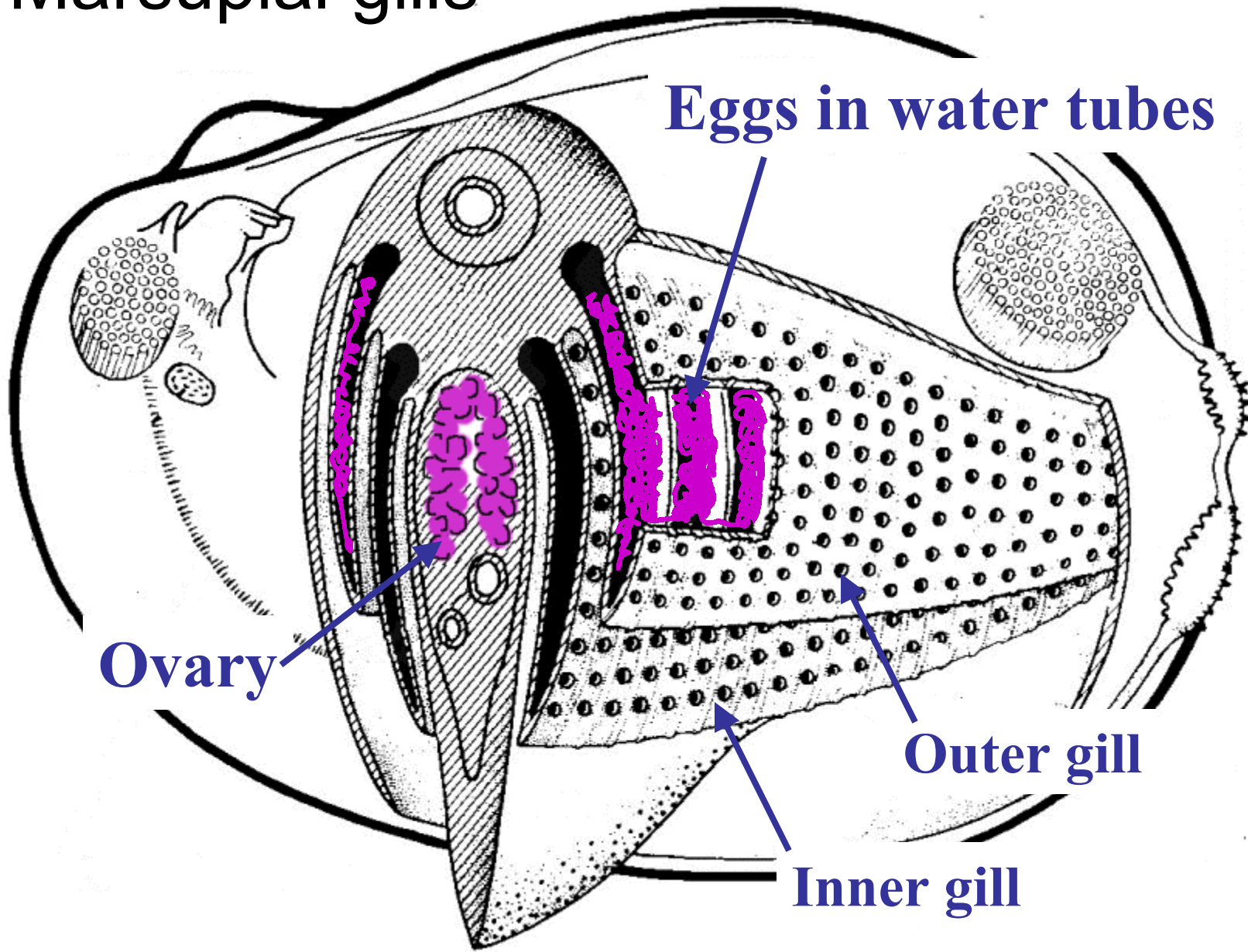
1 mm



Native mussel life history



Marsupial gills

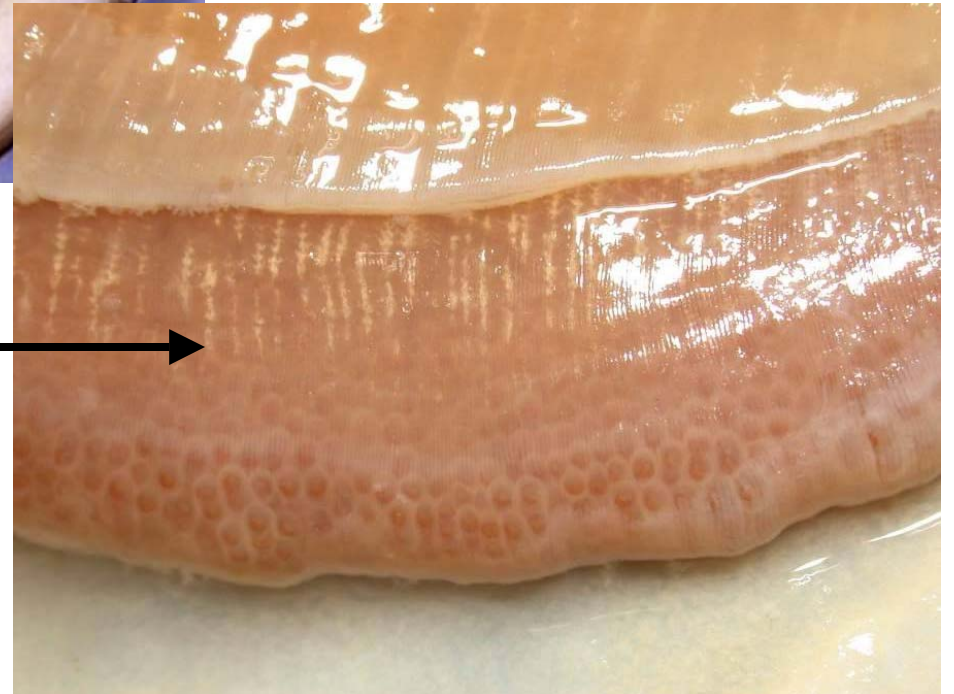


Marsupial gills



Gravid outer gill of
flat floater
(*Anodonta suborbiculata*)

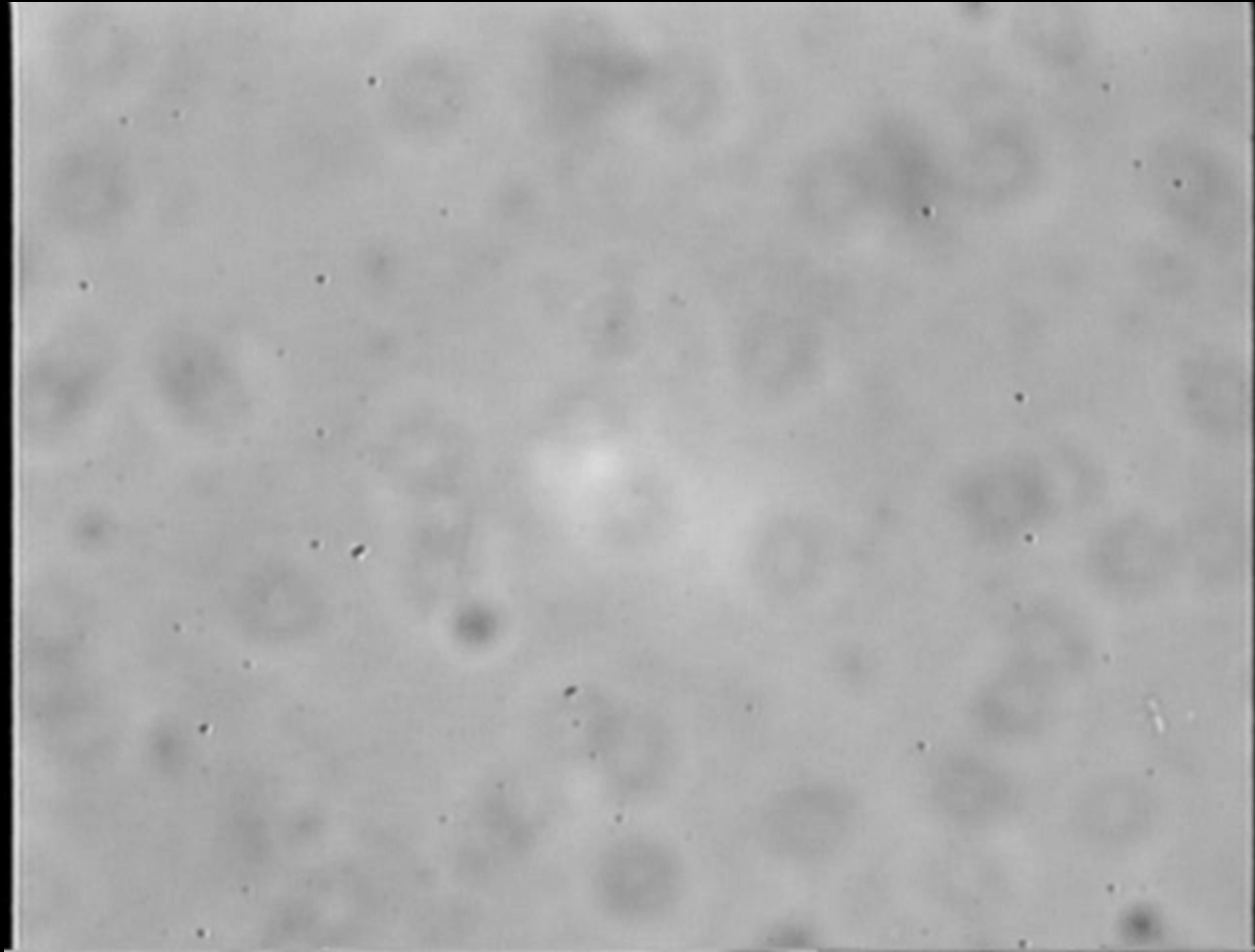
Gravid outer gill
of squawfoot
(*Strophitus undulatus*)



Gravid marsupial gills of *Lampsilis*



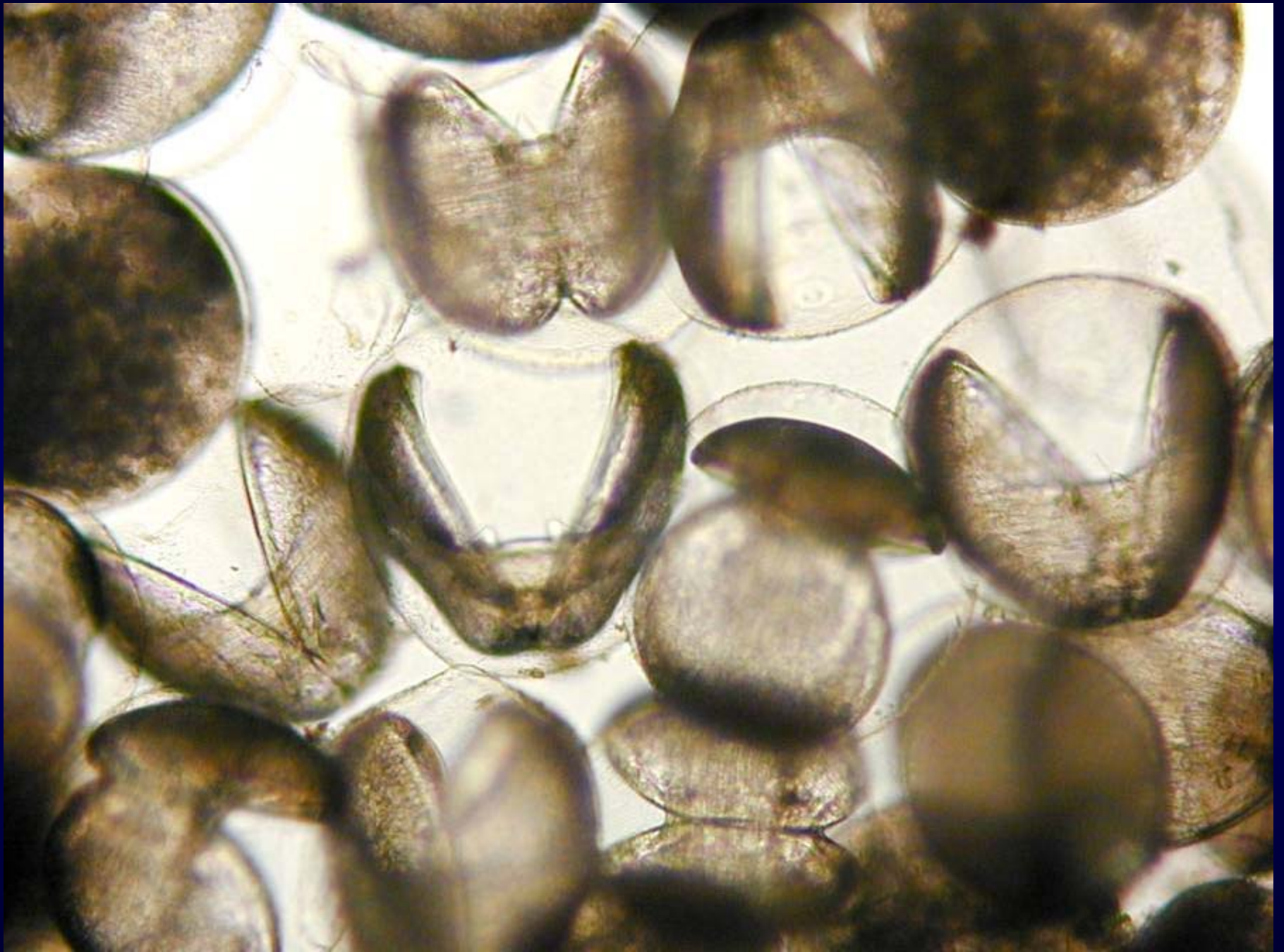
Spermatozeugmata



Embryos of *Elliptio*

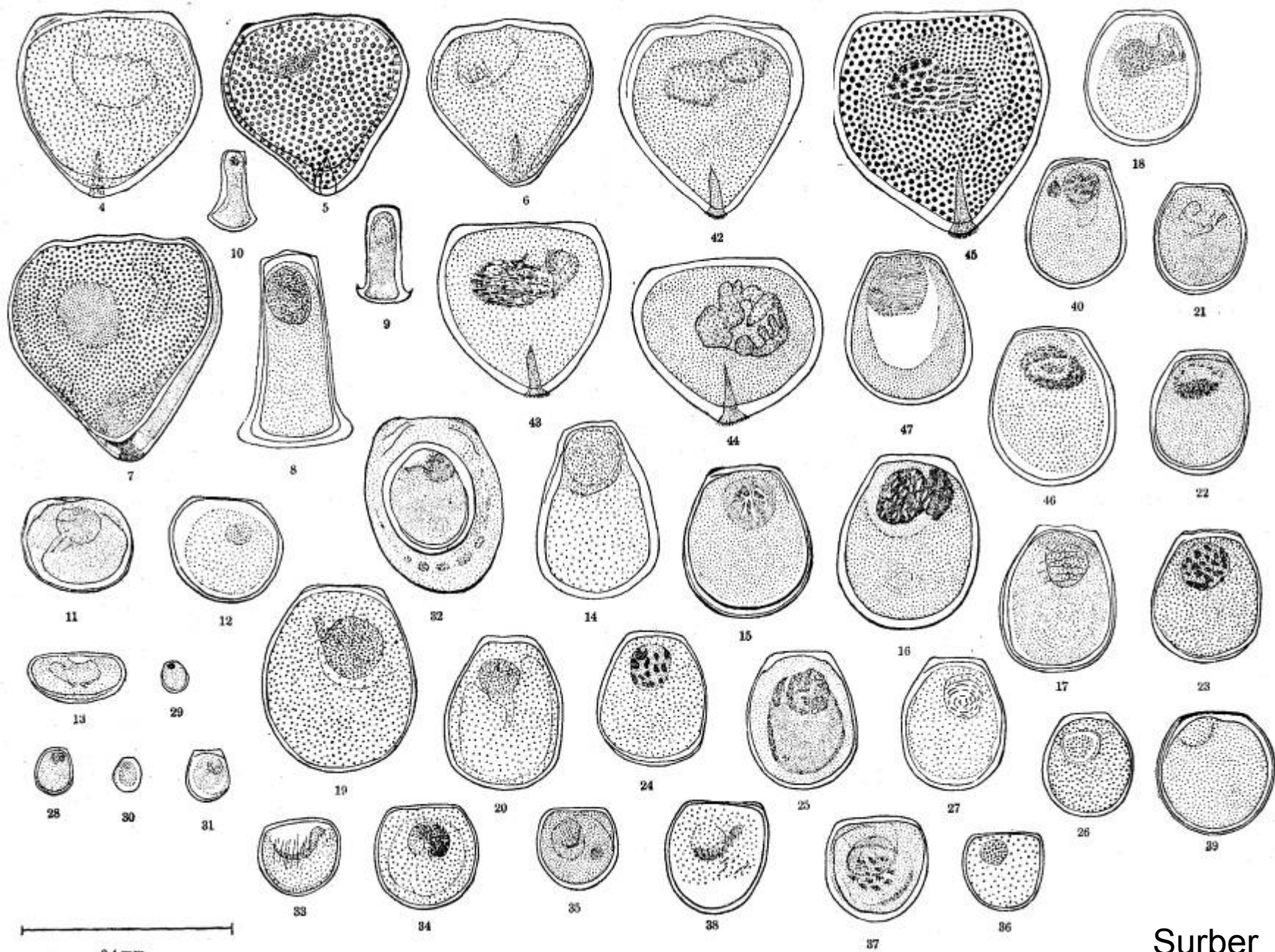
1 mm





Glochidia



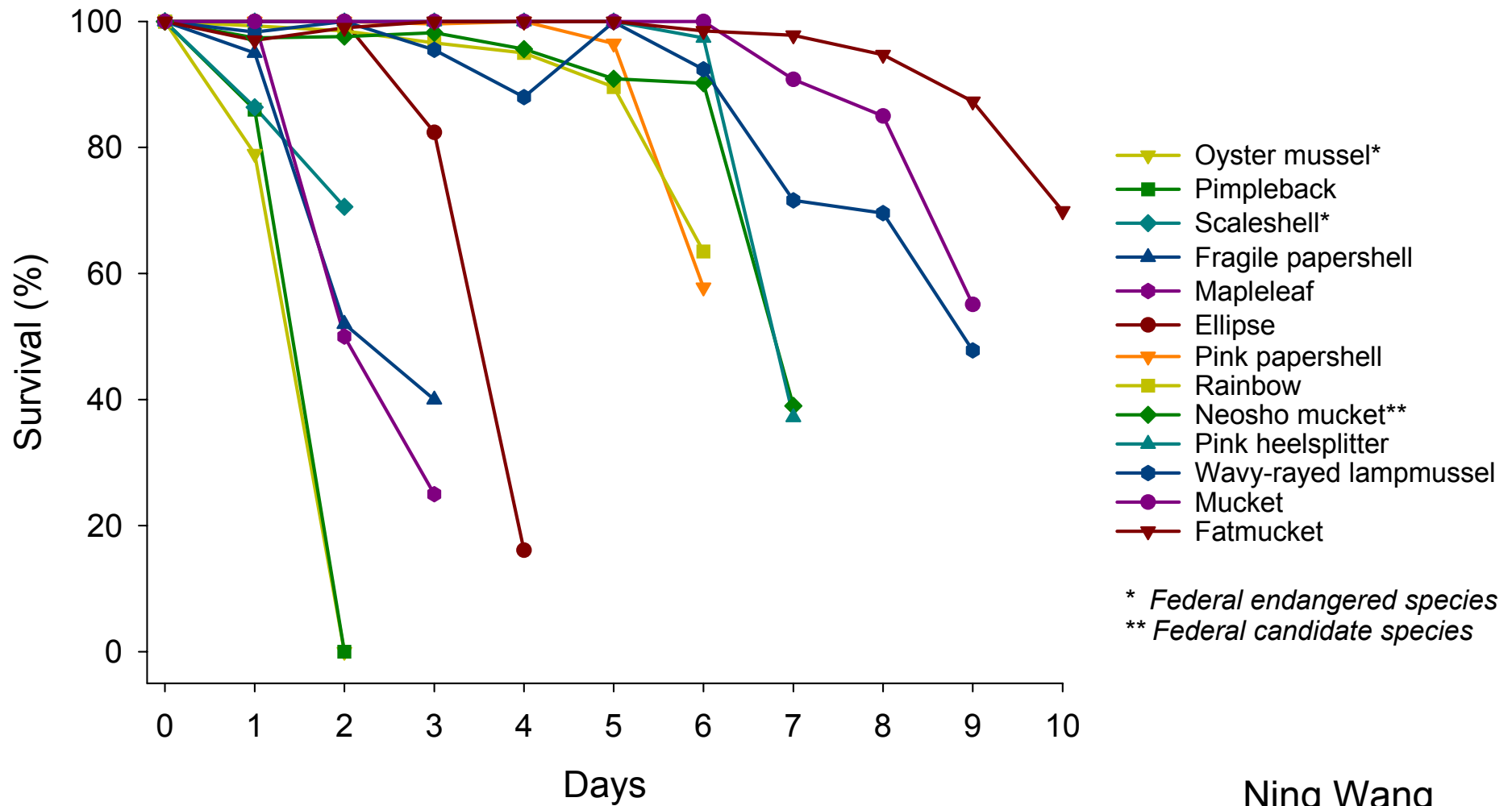


Surber

Glochidia closing in response to salt



Glochidia: Survival time after removal from female mussels



Ning Wang

Attachment & encystment

- Glochidia attach by closing on the gills or fins of hosts.
- On a compatible host, glochidia are quickly encysted by host tissue.
- Each mussel species can use only particular species of host fish

0.1 mm





Mussel host infection strategies

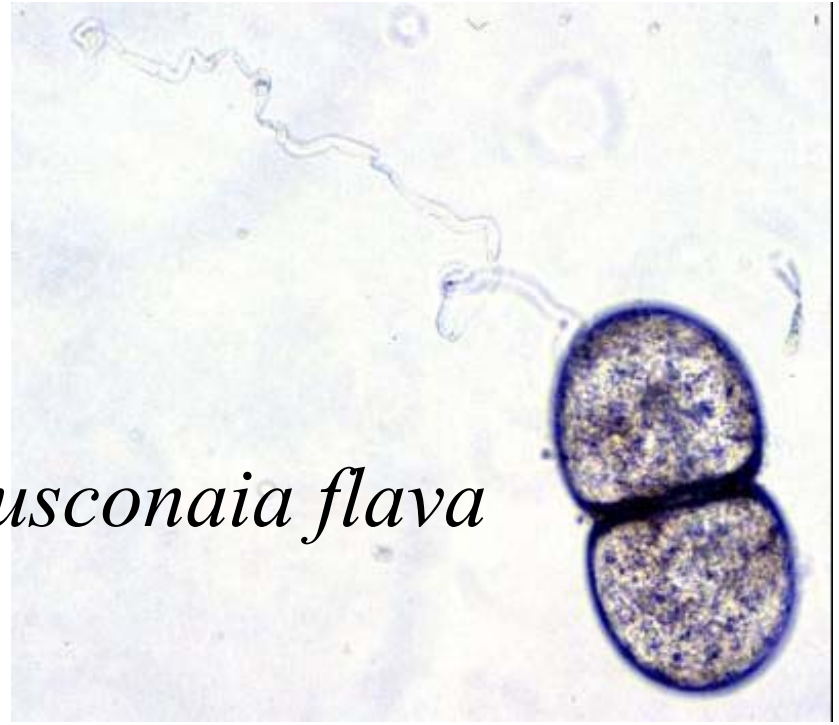
- Broadcast glochidia
- Package glochidia as “bait” (conglutinates)
- Attract host to with anatomical “lures”
- Grab the fish by the head

Salamander mussel, *Simpsonaias ambigua*,
releasing glochidia (entrained by larval threads)

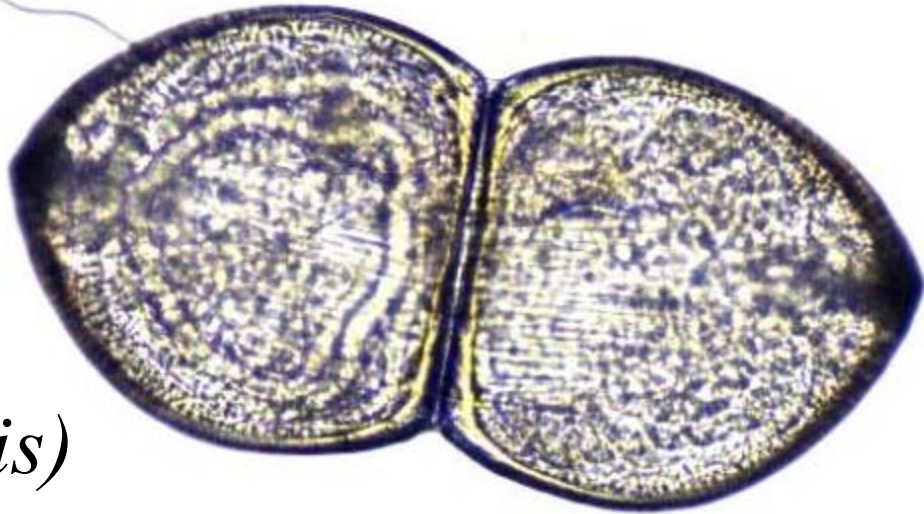


Larval threads

Fusconaia flava

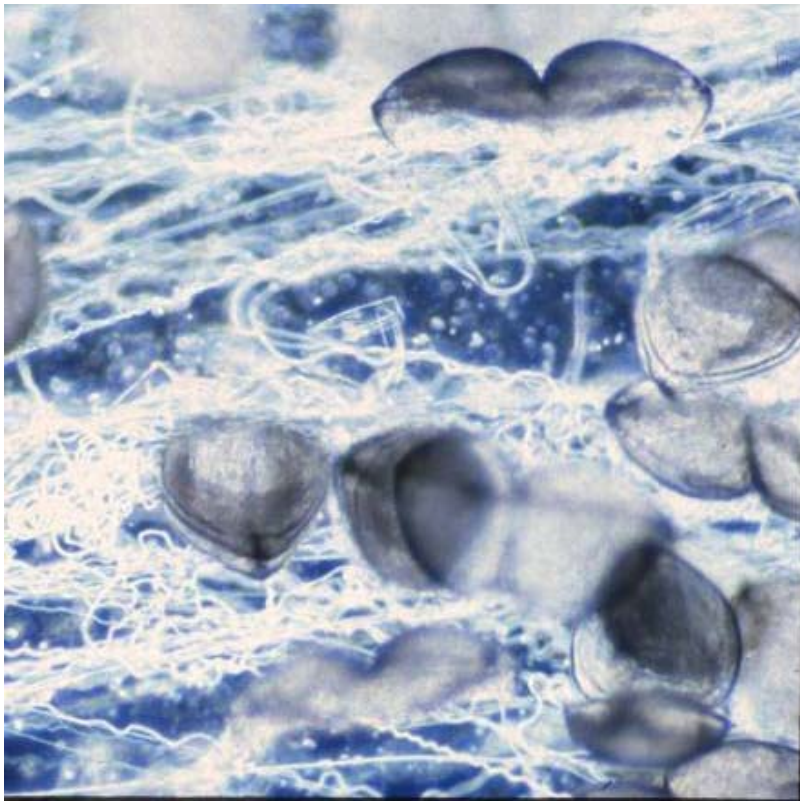


(Utterbackia imbecillis)



Fishing with a net:

Larval threads form a network that suspends glochidia in water column (*Anodonta suborbiculata*)



Conglutinates



Mantle lures



Dispensers



Trappers



Conglutinates

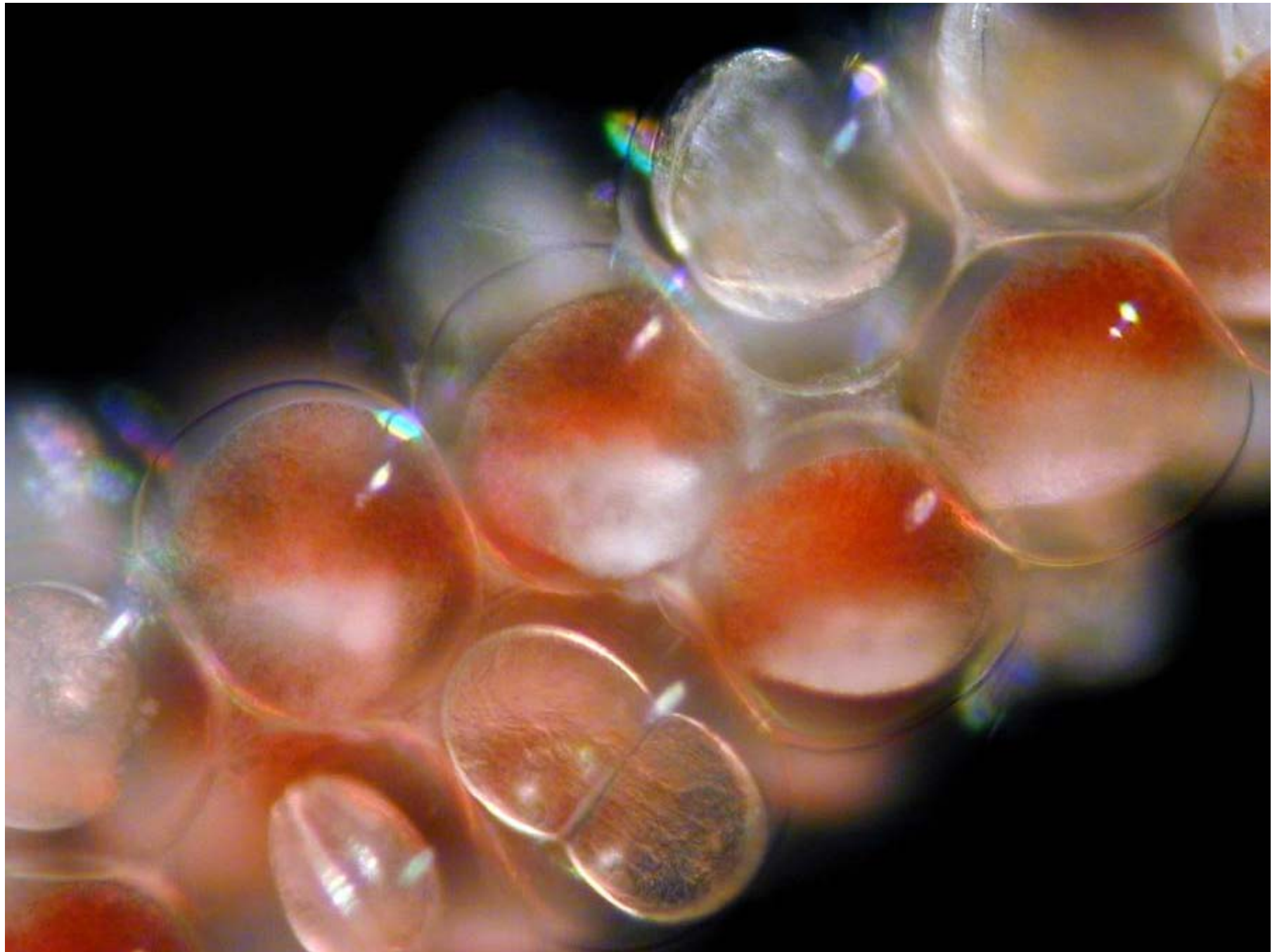


Obliquaria reflexa



Fusconaia flava









Ouachita kidneyshell
Ptychobranthus occidentalis



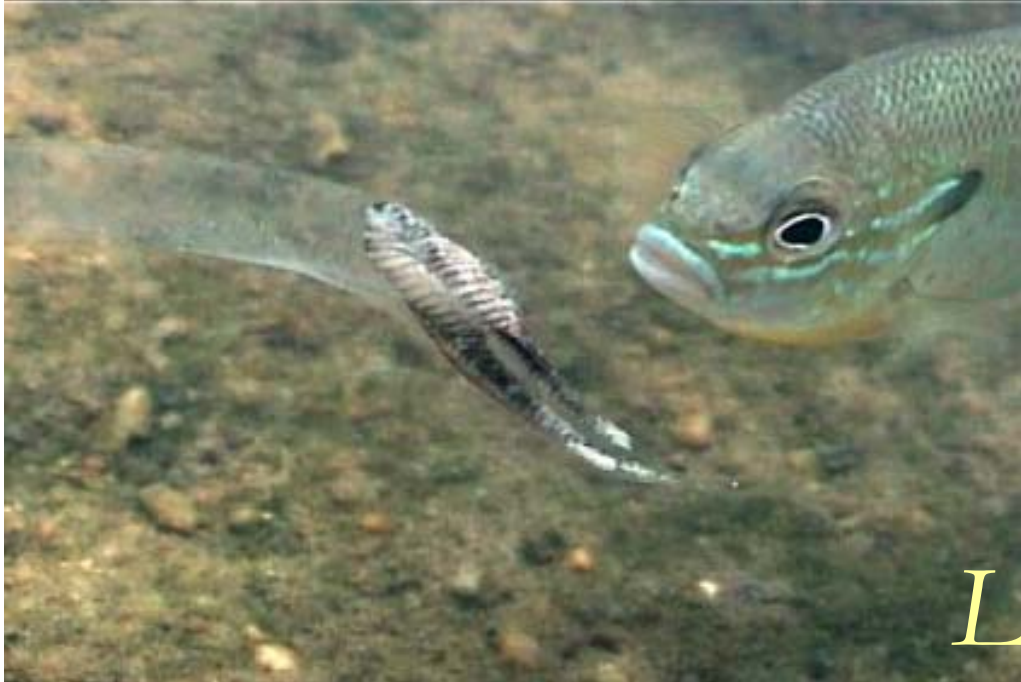
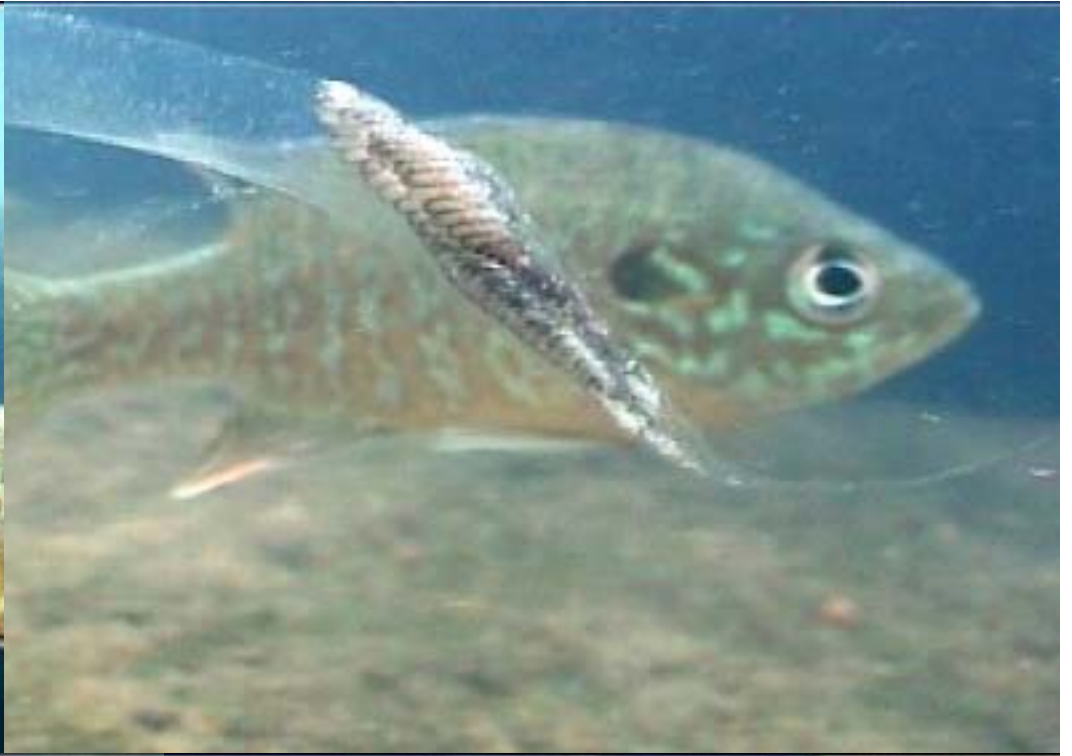
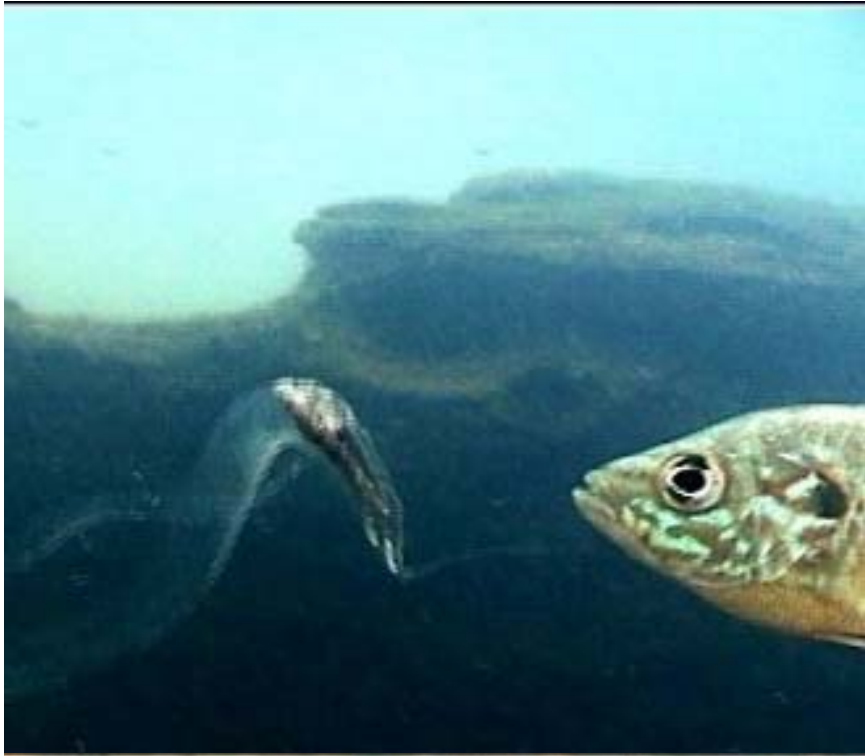
Fluted kidneyshell





Lampsilis perovalis superconglutinate





Lampsilis subangulata

Lampsilis reeveiana




Lampsilis reeveiana



Host attraction by *Lampsilis reeveiana*





0.1 mm

This is a microscopic photograph showing several juvenile mussels. The mussels are dark, almost black, with a slightly textured surface. They are arranged in a cluster, with some showing more detail than others. A scale bar in the top left corner indicates a length of 0.1 mm. The background is a light, uniform color.

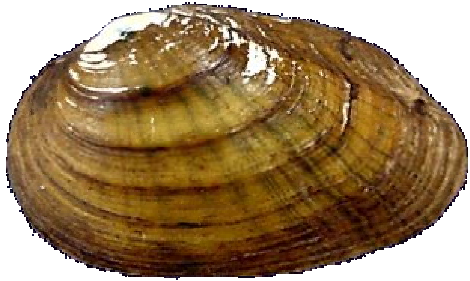
Juvenile mussels just
after leaving the host

Young juvenile mussels are meiofauna

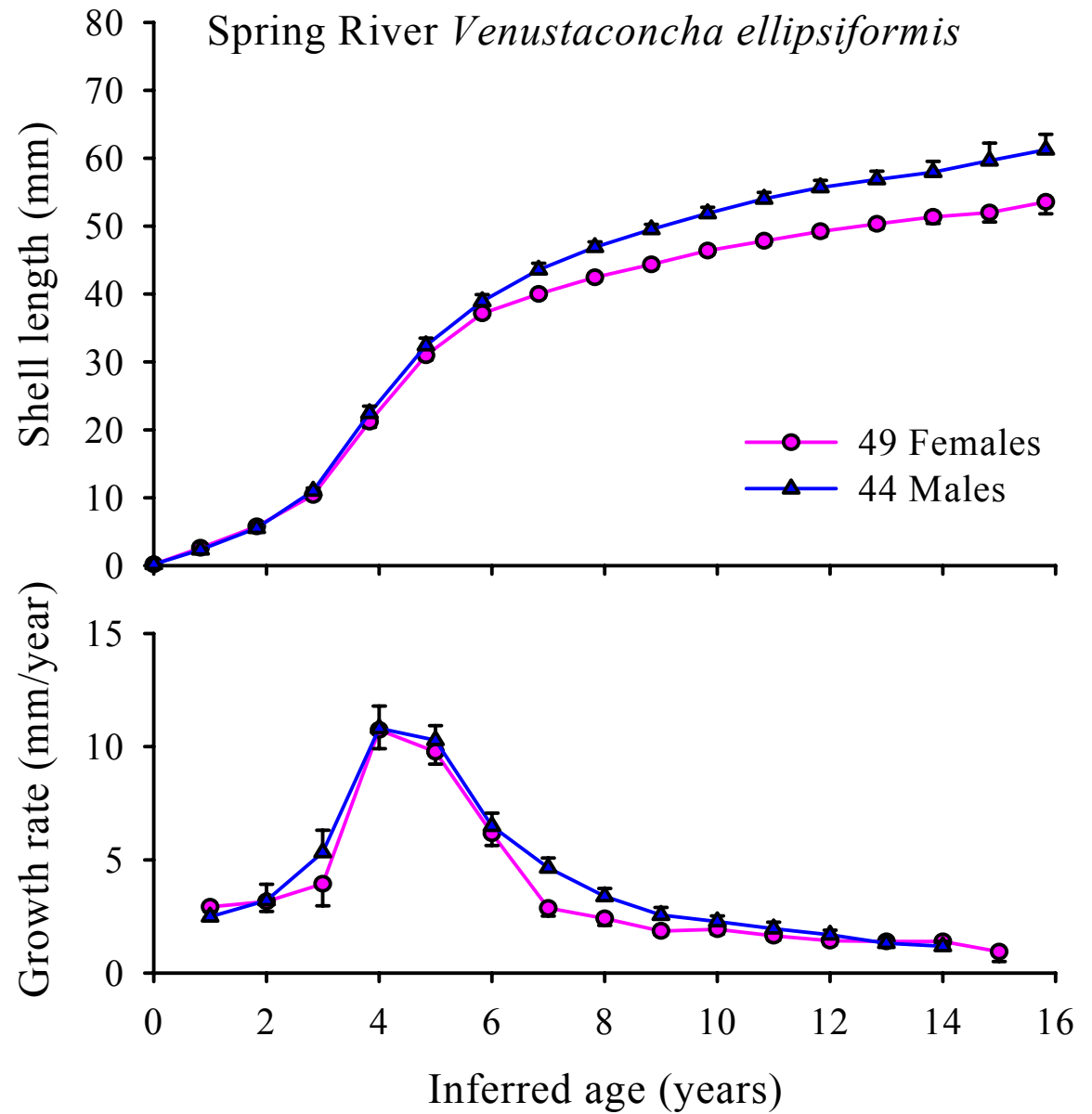


Shell growth lines document age and growth.





Age and growth of *Venustaconcha*



Some species reach great age.



Take-home points

- Highly diverse, abundant, and widespread taxon
- Ecological and economic importance
- Conservation significance- large number of imperiled species
- Complex life cycle with unusual range of exposure to dissolved, suspended, and deposited pollutants



Conglutinate release by *Pleurobema coccineum*





M C Barnhart

